TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

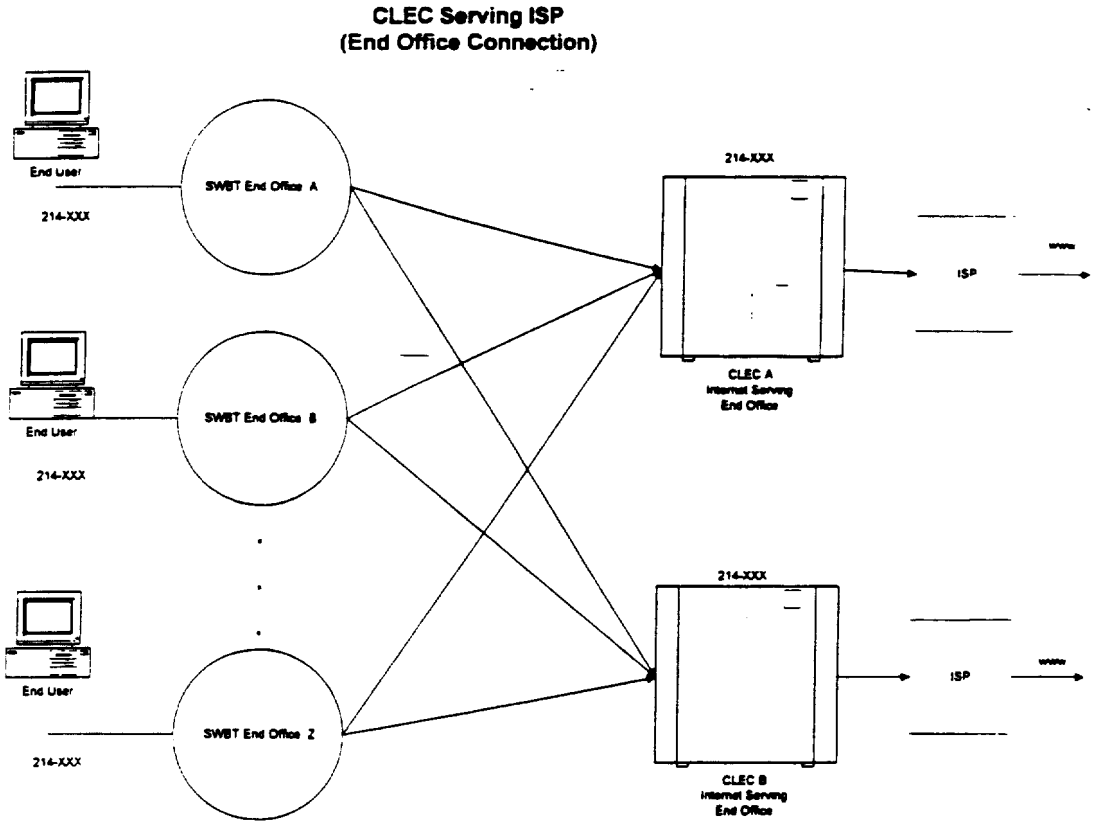
Abstract

The Telecommunications Act of 1996 mandated that local exchange carriers be compensated for the cost of terminating local telecommunications traffic originated by another carrier. This study develops the terminating costs to a Competitive Local Exchange Carrier (CLEC) for handling calls from Southwestern Bell Telephone (SWBT) customers which are bound for Internet Service Providers (ISPs) served by the CLEC.

When a SWBT customer originates a call to an ISP served by a CLEC, the call is transported from the customer's premises via the SWBT network to a CLEC's end office switching system. From there, a connection is made by the CLEC to the ISP. End office *termination* costs include the costs of end office switching plant involved in the ISP *call set-up* and in providing a "call path" through the switching system for the *call duration.* Costs include capital costs of plant and associated maintenance and other operating expenses.

The diagram below depicts the common occurrence whereby a CLEC would connect to SWBT end offices and provide service to an ISP.

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000



This cost analysis has been developed to address the unique end office terminating costs for high-volume, one-way calls with long holding times that are characteristic of Internet traffic. SWBT has used its own end office terminating costs as a surrogate for the cost of the CLEC to handle Internet-bound traffic.

CLECs may choose to use switching systems of their choice. CLECs are expected to use the latest, most efficient switching systems from vendors such as Lucent Technologies, Nortel and others. To estimate CLEC costs, SWBT used cost information for Lucent, Nortel and other digital switching systems, which it employs in Texas. Switching equipment prices are those ordered by the Texas Public Utilities Commission in the Mega-Arbitration Dockets 16189, 16196, 16226, 16285 and 16290.

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

Methodology

A Cost Analysis for Internet-bound Traffic has been developed to calculate the unique end office terminating cost characteristics for carrying certain calls from a Southwestern Bell Telephone end user through a Competitive Local Exchange Carrier ("CLEC") end office. The study seeks to determine the cost of terminating high volume, one-way calls with long holding times that are characteristic of Internet traffic. This study develops set-up and duration terminating costs for an Internet-bound call. This section sets forth the methodology used in the development of those costs.

Description of CLEC Termination Costs and Cost Model

CLEC termination costs consist of two components – the costs of *call set-up* and *call duration.* Each represents a distinct function in terminating a call originated by a SWBT telephone subscriber.

Call set-up. The call set-up requires the use of a digital switch central processor, perhaps other switch processors, and measurement equipment. Incoming call attempts during the CLEC switch busy hour determine the capacity requirements for these equipment items, and therefore, cause the costs for these switching resources.

Call duration. Once a call is established, line and trunk peripheral equipment in the switching system are used to provide a call path for the incoming call. Only the usage sensitive costs of the line and trunk equipment are considered to be termination costs. Call duration, measured in minutes of use (MOU) or one hundred call seconds (CCS), during the busy hour determine the capacity requirements for line and trunk equipment and their costs.

CLEC termination costs were estimated by first measuring the total minutes of use and total messages to ISPs originated by SWBT customers in Texas. Based on these statistics, it was determined that the average duration of an Internet-bound call is approximately 29 minutes. The section titled, Usage Report, describes how these statistics were obtained.

To determine the portion of the traffic occurring during the busy hour, statistical information for Internet-bound minutes of use and messages by hour of the day also was gathered. This information indicated that the busiest hour of Internet-bound minutes of use during the day was 6.9% of the total; for messages, 6.7%

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

occurred in the busiest hour. For study purposes, this hour was assumed to be the CLEC switch busy hour. To estimate the traffic load on CLEC switches during the busy hour, the total minutes of use and messages were divided by 365 days per year to calculate average daily volumes. The daily minutes of use and message volumes, then, were multiplied by 6.9% and 6.7% respectively to compute the minutes of use and messages during the switch busy hour.

The resulting call volumes, representing the Internet-bound traffic during peak use periods, were applied against equipment prices developed from the Switching Cost Information System (SCIS). These equipment prices are the same as those ordered by the Texas Public Utilities Commission (PUC) in the Mega-Arbitration. SCIS produced the following documents which were used in developing the equipment price investment results: Study Level Input Statistics Reports (See Inputs Section - Tab 4 for the reports); Grand Weighted Investment Reports (See Inputs Section - Tab 5 for the reports); and Grand Weighted SMORT to NCAT Reports (See Inputs Section - Tab 6 for the reports). Also, Real Time Tables from Telcordia Technologies Network Cost Analysis Tool (NCAT) were used in this study (See Inputs Section - Tab 7 for the reports).

SCIS develops switching equipment price investments. SBC licenses SCIS from Telcordia Technologies. SCIS is an engineering model that contains vendor price information, capacities of switch components, and engineering guidelines. SBC gathers specific engineering data about each switch and inputs that information into the SCIS model. SCIS then determines the equipment price investment needed to provide various switching functions. An engineering model is a good choice for developing switching data because it uses specific prices, capacities, and engineering data to develop reliable investments. In addition, all investments developed are based on forward-looking switch types.

The calculations of CLEC termination investments for call duration and call set-up were made in an Excel Model, which is contained in the Inputs Section - Tab 2. The Model contains all data used to estimate CLEC termination costs, and all equations are displayed on the spreadsheets. The Model is fully transparent. Input data, such as SCIS switch equipment price investments and switch usage values, are documented in the accompanying backup materials to this analysis. Also, a spreadsheet tracking index can be found in the Inputs Section - Tab 3.

Following is a description of the calculations for call duration and call set-up investments (EF&I) performed in the Excel Model.

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

- Page 1 of the Model shows the total ISP annual minutes of use, days per year and percent of traffic in the busy hour. These are input values to the Model. The Model calculates busy hour minutes of use (or peak usage) by dividing the annual MOUs by 365 days per year, and multiplying the quotient times 6.9% of daily minutes that occur during the busiest hour. BH Messages are developed using the same methodology. For messages, 6.7% occur during the busiest hour. BH MOUs are converted to BH CCS (hundred call seconds), which is the traffic measure used in sizing switching systems, by applying a factor of 0.6 (60 seconds / MOU divided by 100 seconds / CCS). BH CCS and messages, together, determine the CLEC switch capacity requirements and costs caused by ISP-bound traffic.

  Page 1 of the Model also shows the percentage of traffic handled by four different switch technologies. These are the digital switch technologies employed by SWBT in Texas. The percentage weightings are based on the relative amounts of SWBT busy hour traffic among the switches. (See page 6 of the Model) The switch weightings are applied to the BH MOUs and messages to determine the peak demand for each switch type.

  Finally page 1 of the Model shows the duration and set-up results of the Model calculations, which are performed on pages two and three of the Model.

- Pages 2-5 of the Model contain the calculations of the call duration and call set-up investments for each of the four switch types. To illustrate, the calculations for the 5ESS switching system are described below.

  Call duration investment. The 5ESS calculations begin by estimating the CLEC investment attributable to call duration. The volume of BH CCS for the 5ESS is multiplied times the SCIS investment per line CCS to compute line CCS investment. This represents the usage sensitive investment in 5ESS line peripheral equipment involved in terminating incoming calls.

  Trunk peripheral equipment also is involved in terminating calls. The number of trunks required to handle ISP-bound traffic is calculated by dividing the BH CCS by 27 CCS / trunk, a trunk engineering parameter ordered by the Texas PUC. The number of trunks is applied to the investment per digital trunk to compute digital trunk investment.

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

Call duration investment is the sum of the line CCS investment and the digital trunk investment. Similar calculations are made for the other switch technologies.

Set-up investment. Call set-up investment calculations are similar among the switch types, although there are slight differences due to differences in the architectures of the switching systems. There are three general components of the call set-up costs: the cost of setting-up an incoming call; the cost of measuring the call; and an additional cost item to account for the additional time the switch is "held" during set-up before the "conversation" or Internet session begins.

Terminating switching systems respond to all incoming call attempts to determine whether a call can be set-up, so the number of call attempts "drives" set-up investment. BH call attempts are computed by dividing the BH messages by the Internet call completion ratio. This ratio was developed from data obtained in the ISP Sample Study discussed below (See Inputs Section - Tab 9 for the report).

A call set-up involves three parts of the 5ESS: the central processor; the switch module processor; and high level service circuit.

- The central processor investment per call attempt is computed by multiplying the milliseconds of processor capacity used per call attempt times the central processor or "getting started" investment per millisecond.

- The switch module processor's capacity is measured in "equivalent POTS half-calls" (EPHCs). So, the number of EPHCs / call attempt is multiplied times the investment / EPHC to capture the switch module processor investment per call attempt.

- The investment for the high level service circuit is included as an investment per terminating call.

These three investments per call attempt are summed and multiplied times the 5ESS BH call attempts to estimate the CLEC investment required to set-up incoming calls.

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

Measurement involves both the switch module processor and Automated Message Accounting (AMA) equipment. The set-up investment attributable to measurement is computed by applying the BH call attempt volumes against unit investments for these equipment items.

Finally, additional investment is included to recognize the extra holding time for switches during call set-up. The number of BH call attempts is multiplied by a time increment of 0.12 CCS over the conversation time of a call. This additional "non-conversation time" consumes line and trunk peripheral capacity; therefore, additional investment is included for the extra line CCS and digital trunks needed to handle the non-conversation time.

Call set-up investment is the sum of the investment for call set-up, measurement and the non-conversation time during set-up.

Call duration and call set-up investments are computed similarly for the Nortel switches and summed on page 1 of the Model. These total amounts are then divided by the ISP annual MOUs and Messages to determine switch Engineered, Furnished and Installed (EF&I) termination investments.

The duration investment per minute and set-up investment per message are entered into the Automated Cost Expense Studies (ACES) [See Inputs Section - Tab 1 for the reports]. ACES is a SBC cost Model designed to identify recurring costs in a consistent and efficient manner. Factors are applied to investments to identify the costs associated with the investments. ACES accepts the investments and the cost factors, calculates the cost and develops a report. ACES produces an output which clearly identifies what factors are applied and how, making the calculations easy to follow. The ACES results used in this study are filed in the Calculations Tab.

Annual Cost Factors

The investment and annual cost factors used in this study were those that were ordered by the Texas Commission in November 1997 in the Mega-Arbitration.

SBC applies factors to add plant investment to a material equipment price and to convert investment to annual expenses. These factors are a ratio of current

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

expense to current investment. When this ratio is multiplied by current investment, the result is the current expense associated with the investment. SBC's use of factors makes the cost study flow easy to understand and audit.

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

SBC develops the following types of factors:

Investment Factors calculate the capitalized expense SBC incurs when equipment is installed. Sales tax, engineering, and plant labor are expenses which must be treated as capital (i.e., investment). These factors determine the amount, in addition to the purchase price of the equipment, to treat as investment.

Investment Recovery Factors (depreciation, cost of money, and income tax) identify the cost of purchasing equipment. Depreciation is the annual expense of recovering capital invested in telephone plant over the service life of the plant. FCC Prescribed depreciation ordered by the Texas Commission was used in this study. When any company places equipment, it incurs a cost for the interest and dividends it must pay for the use of the money that bought the equipment. Because this cost of money is earnings, income tax must be paid on those earnings. The cost of money percentage ordered by the Texas Commission was 10.36%.

Operating Expense Factors calculate the yearly operating cost associated with equipment. Maintenance and support assets are examples of this type of cost.

Usage Data

SWBT end offices have the Automatic Message Accounting (AMA) capability. AMA is the process used to provide billing usage measurement data for all recorded calls. This data is used to permit charging to the end user customers for use of network services or to enable billing of carriers (including Interexchange Carriers [ICs] and other Local Exchange Carriers [LECs]) for compensation purposes.

For calls within the local area, SWBT does not normally create an AMA record. However, since SWBT must compensate CLECs for minutes of use on calls originating in the SWBT network destined for the CLEC network, translations occur in each SWBT end office to screen for calls to an NPA-NXXs assigned to CLECs. When this occurs, the SWBT end office creates an AMA record for these calls.

The AMA records are sent to SWBT internal billing programs which convert the records into the Exchange Message Interface (EMI) format. If a record is

TEXAS 1997
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
TOTAL ELEMENT LONG RUN INCREMENTAL COST STUDY
JANUARY 2000

identified as going to a CLEC NPA-NXX (based on the called number), it is converted to a "Category 92" record. These records are passed to the Primary Carrier System (PCS) where they are held until the end of the month. The PCS is the system used for the billing of local and intraLATA toll inter-company compensation. At the end of the month, these records are summarized and forwarded to the appropriate CLEC so they can bill SWBT the appropriate rate elements.

Usage Report

Using the Summary Report from the Primary Carrier System (described above), a report was created for Texas. This report identifies the minutes of use and messages originated by SWBT end users to a CLEC telephone number that are likely destined for the Internet. The report used in this analysis shows aggregated data for all CLECs and is not CLEC specific. The report shows monthly data for the period from November 1998 through October 1999; the twelve-month totals were used as inputs to this analysis. This report is included in the Inputs Section under Tab 8.

Other Data (ISP Sample Study)

In addition to the Primary Carrier System Output Report described above, the analysis also used data from a separate study of Internet traffic (ISP Sample Study) conducted in Austin and San Antonio in March 1998. The results of the ISP Sample Study are included under Tab 9 of the Inputs Section. The ISP Sample Study provided two inputs: (1) the percentage of minutes and messages which occur in the Busy Hour for Internet calls, and (2) the Completion Ratio for Internet calls.

Conclusion

This study provides a valid estimate of the terminating cost to a CLEC for the handling of Internet-bound traffic. Usage data are based on actual measurements of ISP traffic, and switching system investments reflect digital switching system technologies and switching system investment amounts ordered by the Texas PUC.

TEXAS
COST ANALYSIS FOR INTERNET-BOUND TRAFFIC
RESULTS

March 2000

	RECURRING COST
SETUP PER MESSAGE FOR INTERNET-BOUND TRAFFIC	$0.000496
DURATION PER MOU FOR INTERNET-BOUND TRAFFIC	$0.000428

CONFIDENTIAL COST STUDIES AND WORKPAPERS TO SUPPORT SWBT COST ANALYSIS FOR INTERNET BOUND TRAFFIC TELRIC STUDY

The methodology and results of this study are provided as (Smith) Attachment 2. The cost studies and workpapers are voluminous and confidential information that has, in many cases, been previously provided through discovery in this docket. Copies of the studies are being provided to the CLEC coalition, Taylor Communications, and the arbitrator. Other parties will be provided copies of the studies and workpapers upon request, pursuant to the Protective Order in this docket. SWBT, hereby incorporates, the cost studies and workpapers as part of the record in this proceeding.

	BATES #	ITEM
1	SWBT0116506 – SWBT0116752	Texas Arbitration Cost Factors Issued 10/20/97
2	SWBT0131873 – SWBT0132412	Network Cost Analysis Tool (NCAT) Production Model Data Base Administrators Guide Vol I (Release 4.4) (supports 11/97)
3	SWBT0131482 – SWBT0131872	Network Cost Analysis Tool (NCAT) Production Model: Calculator User's Guide Vol II (Release 4.4) (supports 11/97)
4	SWBT0135419 – SWBT0135859	SCIS Texas 11/97 Total Investment Reports Release 2.20 October 1997 (supports 11/97)
5	SWBT0133750 – SWBT0134384	SCIS Texas 1997 DMS-100F Investment Reports and Office Inputs Release 2.20 October 1997 (supports 11/97)
6	SWBT0134385 – SWBT0134781	SCIS Texas 1997 4ESS, DMS-10, AXE-10 Investment Reports and Office Inputs Release 2.20 October 1997 (supports 11/97)
7	SWBT0134782 – SWBT0135418	SCIS Texas 1997 5ESS Investment Reports and Office Inputs Release 2.20 October 1997 (supports 11/97)
8	SWBT0151368 – SWBT0151823	Texas Cost Factors and Labor Rates
9	SWBT0124333 – SWBT0124367	ACES (Automated Cost Expense Studies) 10/98
10	Diskette	Texas Cost Factors and Labor Rates 1 of 2
11	Diskette	Texas Cost Factors and Labor Rates 2 of 2
12	Compact Disk	Texas SCIS Release 2.20 October, 1997 Supports Nov 1997 Studies

ATTACHMENT C

REVENUES	
Monthly MOU *(Note 1)*	1,106,672,602
Calendar Day MOU (Monthly MOU X 12 / 365)	36,383,756.78
Business Day MOU (Calendar Day MOU / .85)	42,804,420
Busy Hour MOU (Business Day MOU X .07)	2,996,309
Busy Hour Seconds (Busy Hour MOU X 60)	179,778,563
Busy Hour CCS (Busy Hour Seconds / 100) *(Note 2)*	1,797,786
Trunks Required to handle Busy Hour CCS *(Note 3)*	69,145.60
ISDN PRIs (Smart Trunks) Required *(Note 4)*	3,006
Average Texas Revenue per ISDN PRI *(Note 5)*	$450
Total Monthly Revenue from ISP (number of PRIs X rate per PRI)	$1,352,849

COSTS	
Monthly MOU	1,106,672,602
Texas TELRIC Rate for Tandem Switching *(Note 6)*	$0.000794
Switching Cost to Serve ISP	$878,698
Texas TELRIC Rate for Transport Terminations	$0.000135
Texas TELRIC Rate for Transport Mileage (1 mile)	$0.000002
Total TELRIC for Transport (Terminations + Mileage)	$0.000137
Trunking Cost to Serve ISP	$151,725
Total Monthly Cost to serve ISP (Switching Cost + Trunking Cost)	$1,030,423

Notes:

(1) - Actual CLEC-switched ISP Minutes of Use (MOU) from SBC studies (1999).

(2) - Series of calculations converts Monthly MOUs to Busy Hour CCS; the engineering assumptions used here parallel those used in the cost studies for tandem switching and transport reflected in the cost analysis portion of this document.

(3) - Trunks required to handle Busy Hour CCS (Assumes each trunk can carry 26 CCS)

(4) - 23 Trunks to make 1 ISDN PRI (T1)

(5) - Revenue is from rates for switching service elements only; does not include any revenues for transport (e.g. DS1 Local Distribution Channels) between the switch and the ISP premises, which would generally also be paid for by the ISP.

(6) - This switching cost is not adjusted to reflect impact of long average hold times of ISP traffic, which results in lower than average per minute costs due to the reduced portion of per-call setup cost for each minute of hold time.